

AN EXAMPLE APPLICATION OF “TIME DEPENDENT “ MODELING METHODS

I. Proposed rule language:

(e) For each pollutant, modeling methods for establishing discharge permit limits that meet the requirements of (a) and (b) above may be either steady-state or time-dependent. A steady state modeling method is one in which model input parameters including flow and pollutant concentrations are assumed to be constant with time in the discharge and in the receiving water. A time-dependent modeling method is one in which model input parameters, including discharge flow, discharge pollutant concentrations, and receiving water flow and receiving water pollutant concentrations may vary with time.

II. Jaffrey WWTF – background information

The Town of Jaffrey operates a lagoon-type secondary WWTF that discharges to the Contoocook River in Jaffrey. 7Q10 at the discharge is 3.33 cfs. The current permit limits are

average daily flow = 1.25 MGD; dilution factor at 7Q10 = 2.45 to 1

6.9 ug/l Cu average daily, 9.3ug/l Cu maximum

7 mg/l average, 16 mg/l maximum CBOD5 summer

14 mg/l average, 40 mg/l maximum CBOD5 winter

7 mg/l average, 16 mg/l maximum TSS summer

14 mg/l average, 40 mg/l maximum TSS winter

6.3 mg/l average 8.6 mg/l max day NH₃ as N May 1 - Oct 31

16.3mg/l average 30 mg/l max day NH₃ as N Nov 1 - April 30

Cu is a toxic constituent with chronic criteria at 2.7 ug/l and acute criteria at 3.6 ug/l at 25 mg/l hardness. Cu criteria is for dissolved concentration. The translator is 0.96 (per Env-Ws 1703.2), and resulting Cu criteria in in terms Total Recoverable Criteria is 2.81 ug/l chronic and 3.75 ug/l acute. Permit limits are issued for total recoverable concentration.

BOD5 and NH₃ are oxygen-demanding constituents, which affect stream D.O. The criteria are 75% saturation daily average (which is temperature-dependent), and 5 mg/l instantaneous minimum. A stream model must be used to estimate stream D.O. under the influence of the discharge.

The Jaffrey WWTF does not currently consistently meet permit limits for CBOD5, NH₃, and Cu. The town is under EPA orders to upgrade the facility.

II. Proposed discharge modeling scenario for Cu

Jaffrey proposes to build a new treatment plant, and use the existing lagoon capacity to store effluent when the Contoocook River flow is less than 7 cfs, discharging a maximum of 1 MGD

on days when river flow is above this value. This will increase the minimum dilution factor to 4.97 to 1.

Modeling for this proposal is time-dependent under the proposed rule language:

Consider modeling for Cu, which is a conservative toxic constituent. Concentration after mixing in the river is estimated by a dilution calculation in which

$$\text{Instream conc.} = \frac{\text{WWTF flow} \times \text{WWTF Cu conc.} + \text{River flow} \times \text{River conc.}}{\text{WWTF flow} + \text{River flow}}$$

WWTF flow may vary, but is assumed constant at the max value of 1 MGD when river flow \geq 7cfs and constant at 0 when river flow $<$ 7cfs. It can be controlled by the WWTF operator

WWTF Cu concentration is variable, and assumed to be log normally distributed with no serial correlation. The distribution of daily average concentrations can be estimated from existing data. Average daily concentration on any day when the WWTF is discharging can be estimated from the distribution

River flow varies, but is assumed constant at the minimum value for which discharge is allowed of 7 cfs.

River Cu concentration varies. Jaffrey will be collecting data on actual concentrations. How to treat this time variation is under discussion, but assumption of a lognormal distribution with no serial correlation is a definite possibility.